Critical Observations on Peninsular Malaysian *Selaginella*

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Abstract

The genus *Selaginella* is represented in the Malay Peninsula by 28 species, including 3 varieties. Three species are here reinstated, 2 from varietal rank *(Selaginella scabrida* Ridl., *S. curtisii* Ridl.) and 1 from synonymy *(S. polita* Ridl.). Two varieties are validated, viz., *S. intermedia* var. *dolichocentrus* Wong and *S. roxburghii* var. *strigosa* (Ridl.) Wong. A key to the species and varieties is provided, and a description of each species is given. Habit, branching, leaf and sporophyll characteristics of the sporophyte plant are reviewed. Habitat preferences and various probable ecological adaptations towards efficient use of light and optimal reproduction are discussed.

Introduction

The genus *Selaginella* in the Malay Peninsula is represented entirely by species belonging to subgenus *Heterophyllum* Hieron. (characterised by dissimilar-sized leaves) which contains a larger number of species with predominantly tropical distribution, as opposed to subgenus *Selaginella* Baker (characterised by similar-sized leaves) which contains a smaller number of species found mainly in temperate regions.

Ridley (1919) gave the first account of the genus *Selaginella* in the Malay Peninsula; he listed 37 species of which 21 he considered possibly endemic. Alston (1934) revised the genus for the Peninsula, reducing the number to 25, treating 6 as endemic and considered that there was quite a range of variation especially with regard to leaf size. By the time his account of the Sumatran species was published in 1937, he had amended the names of 4 of these species *(S. peltata* Presl to *S. caulescens* (Wall.) Spring, *S. polystachya* (Warb.) Hieron. to *S. permutata* Hieron., and both *S. ascendens* v.A.v.R. and *S. atroviridis* (Wall.) Spring to *S. intermedia* (B1.) Spring), and added 2 more species to the Malayan list *(S. stipulata* (B1.) Spring and *S. longiaristata* Hieron.). The last 2 species had been previously listed by him as varieties. The number of species accounted for by Alston therefore came to 26.

The present study recognises 28 species of which nine are considered to be probably endemic to the Malay Peninsula.

Habit and Morphology

In habit, species may be prostrate and creeping, such as *S. alutacia, S. strigosa* and *S. mayeri* (Plate 1), or suberect, e.g., *S. intermedia* (Plate 2) and *S. roxburghii*, ranging to scrambling, as in *S. willdenowii* (Plate 3). The stem, as in the last case, may continue for several meters, or, as with *S. morgani* and *S. stipulata*, be relatively short so that the plants are small.

The branching habit of the plant body is functionally dichotomous, so that references to 'pinnate branching' and 'fronds' may not be apt. The main 'stem' is a zigzag series of axes resulting from the alternate promotion of right and left branches of successive dichotomies. The term 'branch' will be used to refer to the weaker axis from each bifurcation along the 'stem' which will develop and ramify into a series of branchlets that ultimately bear the strobili. 'Branch-system' as used here includes the branch and the higher-order axes developing from it; to this, Alston (1934) had applied the term 'pinna'.

The branch-system is a series of dichotomies, also anisotomous in nature so that one of two main conditions may result (Fig. 1):

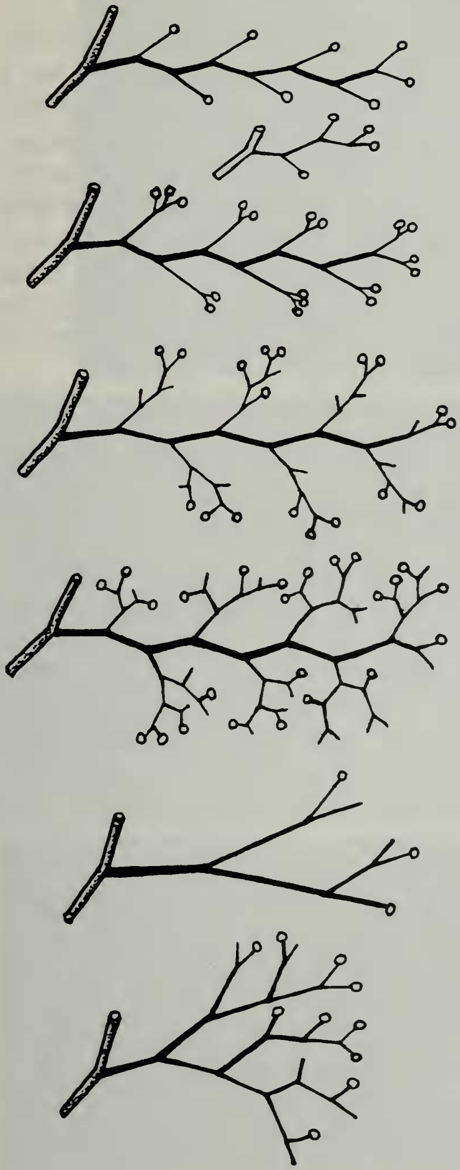
(a) A pseudopinnate array, in which an apparent main branch axis is recognizable, composed of a series of the more robust member from each dichotomy. Here, the less robust members of dichotomies will be in a distichous type of array, and may remain unforked *(S. wallichii),* bear 1-2 unpronounced dichotomies at the tips *(S. stipulata)* or else they may be ostentatiously dichotomizing *(S. willdenowii, S. intermedia).* Alston (1934) used the term 'pinnula', seemingly for each structure formed from the less robust members of dichotomies along the apparent main branch axis.

(b) A fan-shaped or flabellate array, in which no apparent unidirectional main branch axis is recognizable, composed of a series of obvious dichotomies (occasionally in *S. cuprea, S. intermedia, S. mayeri* and several others).

In each case the resulting appearance depends on the extent of dichotomy present. As can be expected, many species will exhibit more than merely one of the conditions from Fig. 1; in *S. wallichii* (Plate 5) and *S. stipulata,* however, a distinct appearance of the branch-system occurs consistently to afford rapid recognition. For these two species, the branch-system consists of the smaller axes in a distichous type of array and near enough for lateral leaves from adjacent branchlets to almost touch so that the entire branch-system appears lanceolate in outline. Other forms may occur consistently in select species, such as Type 3 of Fig. 1 for *S. frondosa* and *S. argentea* (Plate 4).

Whether or not branch-systems occur in the lower portion of the stem also contributes to the general appearance; in species such as *S. wallichii, S. caulescens, S. frondosa* and *S. argentea* the branch-systems are crowded at the upper part of the stem whereas in the creeping *S. mayeri* and the scrambling *S. willdenowii,* branch-systems arise at more regular intervals along the comparatively long stem (compare Plates 1, 3 & 5).

Roots commonly develop at the distal ends of rhizophores, which are positively geotropic, elongate organs possessing no root cap and often arising at points of bifurcation in the shoot. In suberect forms the development of rhizophores and roots is significantly pronounced towards the base of the stem while in creeping forms, rhizophores spring from throughout the shoot system and strike roots where they come into contact with the substrate. Occasionally, the emerging axis at a



1. Pseudopinnate; smaller axes simple. (e.g., *S. wallichii,* and in condensed form in several creeping species)
2. Pseudopinnate; smaller axes forking at tips. (e.g., *S. stipulata)*
3. Pseudopinnate; smaller axes dividing in pseudopinnate fashion. (e.g., *S. willdenowii, S. argentea, S. frondosa*)
4. Pseudopinnate; smaller axes obviously dichotomized. (e.g., *S. intermedia, S. caulescens, S. roxburghii)*
5. Flabellate, with few dichotomies. (e.g., *S. intermedia, S. alutacia, S. mayeri)*
6. Flabellate, much dichotomized. (e.g., *S. intermedia, S. cuprea, S. plana)*

Fig. 1 Branch-systems in *Selaginella.* Circles represent strobili.

point of bifurcation becomes transformed into a normal shoot instead of being the usual rhizophore.

The leaves are arranged in four rows along the branches and are anisophyllous so that a dorsi-ventral disposition results. The two rows of leaves in the upper plane are smaller and occupy a relatively median position, and are referred to as the median leaves. The two rows of leaves in the lower plane, larger and more lateral in position, are called lateral leaves. There is at each bifurcation in the branch-system also a leaf somewhat 'axillary' in position; this is termed the axillary leaf and is often better observed on the lower plane.

In form, the leaves take up various shapes (Fig. 2) and the margin may be entire to dentate or ciliate. The leaf surface may be glabrous or hairy to various degrees. I agree with Alston (1934) that the shape and margin of leaves present relatively constant character-states. In some species, the leaves near the base of the stem are of similar size so that the anisophylly so evident for the branch-system is obscured; in such cases the basal leaves may be spaced relatively further apart and range from erect and appressed to ascending in position. In others, the anisophylly of leaves is distinctly present throughout the plant's shoot system. Characteristic colours of the foliage may develop, such as the coppery tinge in *S. cuprea;* in *S. willdenowii,* the colour varies from green to bluish (Plate 3) while the usually dark green foliage of *S. intermedia* is occasionally purplish or coppery.

The leaves of *Selaginella* have been morphologically termed 'microphylls' (e.g., Foster & Gifford, 1974) to indicate their fundamental difference from the leaves ('megaphylls') of ferns and seed plants through the presence of a solitary unbranched vascular trace which is not associated with any leaf gap in the stele. However, there is no obligatory correspondence between leaf gaps and leaf traces in ferns such as *Gleichenia* and the Hymenophyllaceae (Boodle, 1901), and branched veins have been observed to be characteristic of *S. adunca* A. Br. ex Hieron. (Mukherjee & Sen, 1981). As such, although the term 'microphyll' may indicate anatomical differences from more complex 'megaphylls', it is not employed here and is more applicable in discussions on structural and evolutionary relationships between the two.

The strobili are terminal on branchlets and can take on two forms, as shown in Fig. 3. In the first, the sporophylls making up the strobilus are all subuniform so that a tetragonous structure results; where the distinct anisophylly of the leaves is continued into the reproductive structures, the second condition with bilaterally organized strobili occurs (Plates 7 & 8). All presently known Malayan species with bilateral strobili have the lower plane sporophylls smaller than those in the upper plane. Microspores are too tiny to be of taxonomic utility under merely 25× magnification, while megaspores have a distinctive triradiate ridge besides being larger and may have the wall reticulately patterned to slightly tuberculate. Both microsporangia and megasporangia occur mixed on the same strobilus although in many cases solely microsporangial strobili were observed. There seems to be no consistent pattern of distribution of megasporangia within the strobilus though quite frequently they occur on the lower plane in scattered manner and cause their

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Plate 1. *Selaginella mayeri* creeping on a rock face. The stem is comparatively long, with branch-systems arising at quite regular intervals along its length.

Plate 2. *Selaginella intermedia* occurring as a patch of individuals with suberect habit. The branch-system can range from the flabellate condition with few dichotomies, as seen here, to the pseudopinnate condition.

Plate 3. *Selaginella willdenowii,* developing a long scrambling stem and a blue-green iridescence in the foliage.

Plate 4. *Selaginella argentea,* displaying branch-systems with a strikingly regular pseudopinnate condition.

Plate 1.

Plate 2.

Plate 3.

Plate 4.

Plate 5.

Plate 6.

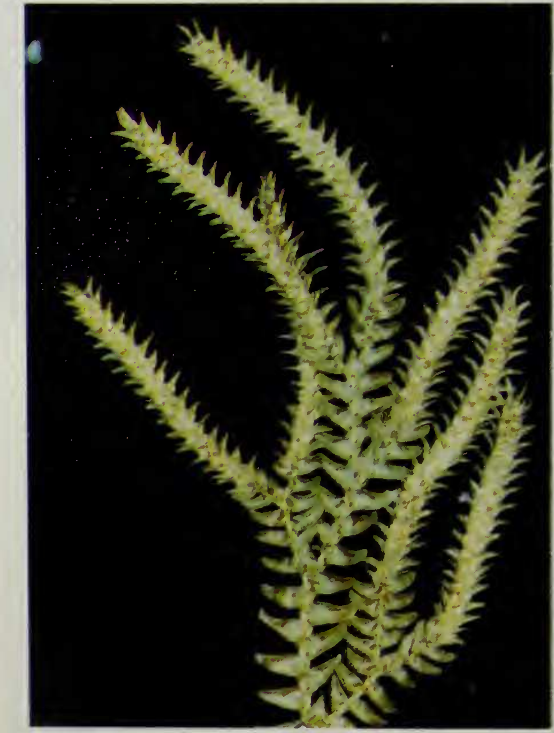
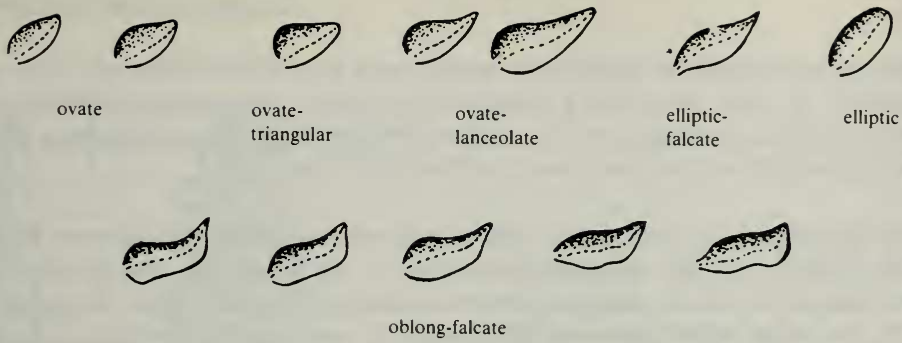
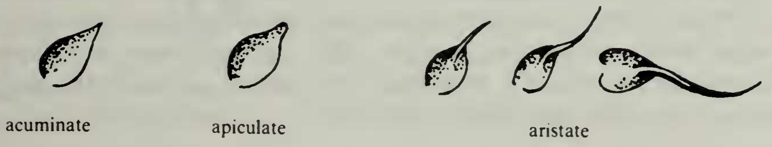


Plate 7.

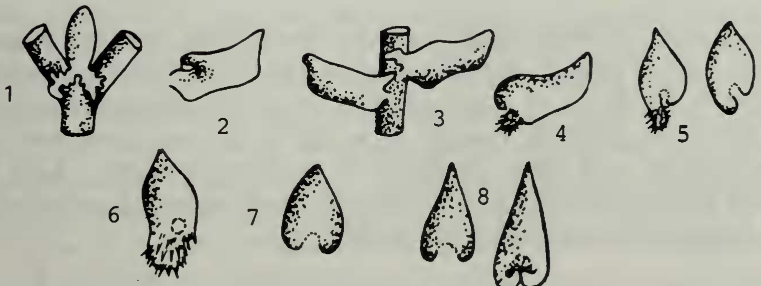
Plate 8.



A. LATERAL LEAF SHAPES



B. MEDIAN LEAF APICES



C. ELABORATION OF LEAVES

1, auriculate axillary leaf; 2-4, elaboration of lateral leaves of the branch-system (2, with auriculate fold at base of upper margin; 3, with auricle at base of upper margin; 4, with subspinose-ciliate projection at base of lower margin); 5-8, elaboration of stem base leaves (5, with one side of the base prolonged into an auricle; 6, subpeltate; 7, cordate; 8, auriculate).

Fig. 2. Some characteristic features of the leaves in *Selaginella.*

See opposite page

Plate 5. *Selaginella wallichii* occurring as a patch of gregarious individuals. Note the distinct pseudopinnate branch-systems with unbranched smaller axes.

Plate 6. *Selaginella intermedia* var. *dolichocentrus.* Note the very long aristae of median leaves along the upper plane of branchlets.

Plate 7. Cone-bearing branchlets of *Selaginella ornata.* View of lower plane, showing the bilaterally symmetrical strobili (cones) with smaller lower plane sporophylls and larger upper plane sporophylls.

Plate 8. Cone-bearing branchlets of *Selaginella polita;* view of lower plane. See discussion on taxonomy for differences between this species and *S. ornata.*

subtending sporophylls to diverge at a greater angle from the strobilus axis (e.g., *S. roxburghii).* In what is termed a tetragonous strobilus, the megasporophylls are sometimes distinctly enlarged as in *S. willdenowii* despite the generally similar sizes of the sporophylls on both the lower and the upper planes.

Each sporophyll is often ovate with a pointed apex, with the concave inner surface cupped over the subtended sporangium; the sporophyll margin may be entire, dentate or ciliate, reflecting a similar condition for the leaves. In bilateral strobili, the larger upper plane sporophylls usually have a strong keel-like piece of tissue running down the inside surface of the sporophyll, along the middle.

Each sporophyll bears a short laminar structure, the ligule, near its base on the adaxial side. Pressed between the sporangium and its subtending sporophyll, the ligule may range from a translucent narrow bifid strip of tissue to a brownish scale-like structure; in any case it is very short, only about one-tenth the length of the sporophyll or less, often shrivelled and all too easily fractured in dried specimens.

Habitat Characteristics and Ecology

Most species occur in damp, shaded microhabitats. Many creeping species, such as *S. alutacia* and *S. mayeri,* are found spreading down moist earth-slopes or covering rocks in the forest or at stream-sides. Even on outcrops of quartzite or limestone, which are generally thought of as rather dry substrates, such species occur along crevices or at places sheltered by overhanging rocks, where the environment has better protection from drying out. As is known, there is no species confined to limestone in the Malay Peninsula.

In the forest, many suberect species are found as part of the herbaceous ground cover and occasionally they may be locally abundant so as to form rather homogenous patches, as with *S. intermedia* or *S. wallichii.* Earth-banks along trails and slopes in the forest are often decorated with the overlapping foliage sprays of suberect species like *S. roxburghii* and *S. stipulata.* There is no doubt that, like mosses and liverworts, where such species occur in dense cover, they contribute towards the checking of soil erosion along slopes.

S. willdenowii, by its rapid spread and clambering habit, is common along forest edges and soon becomes a smothering weed at many clearings and gaps. It can, however, grow lushly in darker conditions in the understorey of the forest, a situation in which its foliage commonly displays a metallic blue tinge (Plate 3). This iridescence is not due to pigmentation but rather a property of the leaf surface which probably behaves as an interference filter that gives peak reflectance at the blue part of the spectrum and increased transmission of light of higher wavelengths, notably those in the red region (Lee, 1977). This seems to be of adaptive advantage since light wavelengths in the red region predominate among photosynthetically active wavelengths in diffuse light reaching the rainforest floor (Sasaki et al, 1978). As in many shade tolerant plants, the iridescent leaves have more chlorophyll per unit protein than leaves exposed to the sun (Krishnan, 1975).

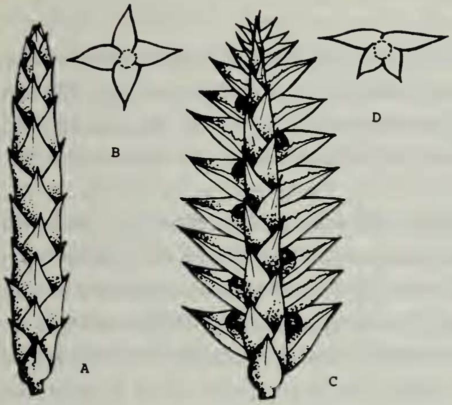


Fig. 3. Strobili in Peninsular Malaysian *Selaginella:* tetragonous type (*A, B*) and bilateral type (*C, D*). *A, C,* surface views; *B, D,* transverse sections.

Chromosomal counts have established basic numbers of x=9 *(S. ciliaris, S. intermedia, S. padangensis, S. willdenowii)* and x=10 *(S. delicatula, S. plana, S. wallichii)* for those Malayan species which have been counted (Jermy et al, 1967). The basic number x=9 was observed to correlate with a sporadic coning habit and an ability to continue branch growth throughout the life of the plant since only some of the growth apices are terminated by cone-formation, and x=10 to correlate with a simultaneous coning habit and finite growth of the branch-systems (Jermy et al, 1967). The act of coning simultaneously at the tips of all branchlets in a branch-system should perhaps not be construed as the factor causing finite growth of the branch-system, but rather as a habit accompanying an inherently determined finite growth; even in *S. wallichii* and *S. stipulata* which frequently bear cones at once on all branchlet tips of the whole aerial system, one comes across plants with a number of sterile branchlets while the remaining branchlets bear well-matured cones.

It has also been hypothesized (Jermy et al, 1967) that a sporadic coning habit, which allows prolonged ability to produce cones, is characteristic of species from more open habitats probably because the coning stimulus may be irregular and less often correlated with conditions conducive to successful propagation. In contrast, simultaneous coning may be an attribute of species in the relatively more stable environment of deep forest since this advantageously adapts the plant to respond to a coning stimulus concurrent with the onset of conditions favourable for effective propagation.

Species which may be said to have wide ecological amplitudes include *S. intermedia,* found from lowlands to montane forest and occuring in moist valleys and slopes as well as on drier hill ridges where the tall forest tree, *Shorea curtisii* (seraya), is dominant. *S. alutacia* is found also from the lowlands to montane forest but essentially occupies the shaded moist microhabitats therein; similarly *S. roxburghii* and *S. wallichii* are found from lowlands to upper dipterocarp forest. On the other hand are *S. morgani, S. ornata* and *S. polita* which occur at higher altitudes, mainly in montane oak or montane ericaceous forests.

Taxonomy

In the present account, 28 species including 3 varieties are recognized. The identities *S. permutata* sensu Alston and *S. stipulata* (Bl.) Spring listed by Alston (1937) are conspecific, having much variation in lateral leaf size and shape of axillary leaves; the earlier name *S. stipulata* is taken for this single species.

Three taxa have their original specific ranks reinstated. The first, *S. scabrida* Ridl. — recombined by Alston (1934) as *S. alutacia* var. *scabrida* (Ridl.) Alston — differs from *S. alutacia* Spring by its denticulate to dentate leaves as opposed to the ciliate leaves of *S. alutacia,* and by its hairy leaves and stems. While within *S. alutacia* the leaves can range from glabrous (usually) to short hairy on the upper surface, stem hairiness does not occur in any other Malayan species and appears to be distinctive. The sporophylls of *S. alutacia* are ciliate while in *S. scabrida* they are short-ciliolate. There is, therefore, some difficulty in considering these entities conspecific even though the leaves are similar in shape.

The second species to be reinstated is *S. curtisii* Ridl., formerly recombined by Alston (1934) as *S. alutacia* var. *curtisii* (Ridl.) Alston. *S. curtisii* has denticulate leaves and acuminate median leaves in comparison to the ciliate leaves and aristate median leaves of *S. alutacia.* An even more striking characteristic in *S. curtisii* is the tightly imbricate sporophylls of the strobilus, with the upper plane sporophylls held at a steeper position, at less than 45° from the strobilus axis; it is perhaps this compact condition of the strobilus that led Ridley (1919) to conclude that it is tetragonous instead of bilateral in symmetry. In *S. alutacia,* the sporophylls are less tightly imbricate with the upper plane sporophylls more spreading, at an angle of 45°-80° from the strobilus axis. Alston (1934) states that the condition of overlapping lateral leaves in his *S. alutacia* var. *curtisii* shows a complete transition to the condition typical of *S. alutacia* (non-overlapping lateral leaves); in this I agree but nonetheless, the other differences support a separate specific identity.

While dealing with specimens of *S. ornata* (Hk. & Gr.) Spring so determined and listed by Alston (1934), it became clear to me that his circumscription of the species contained two rather distinct elements, although in his treatment of the Javanese species (Alston, 1934b) he did comment that there was an enormous variation in leaf dimensions for *S. ornata.* The first element has oblong-falcate lateral leaves and a larger overall size with broader spread, and conformed to Ridley's description (1919) of *S. brachystachya* var. *ornata* (Hk. & Gr.) Baker (Alston did not give any description but reduced this to *S. ornata)* — this element is maintained here as *S. ornata* (Plate 7). The second element is comparable to the type of *S. polita* Ridl. (kindly confirmed by Dr. A.C. Jermy at the British Museum) which had been reduced to synonymy under *S. ornata* by Alston (1934); specimens representing this element have ovate to lanceolate lateral leaves (Plate 8) and smaller stature. Furthermore, this second element has bilateral strobili with the upper plane sporophylls only slightly longer than those of the lower plane, whereas in *S. ornata* as understood here, the upper plane sporophylls are as much as twice longer than the lower plane ones. *S. ornata* also has distinctly aristate median leaves while *S. polita* has acuminate to shortly aristate median leaves (the arista less than a fifth the length of the lamina). As such, *S. polita* is here reinstated.

Malayan species (being, as mentioned earlier, entirely within subgenus *Heterophyllum* Hieron.) may be naturally divided into two main groups. The first main group has tetragonous strobili and was called Section *Homostachyeae* by Ridley (1919); one has to bear in mind that under an earlier classification not adopted here, the group referred to presently would be considered as subgenus *Stachygynandrum* Baker, while under that same classification subgenus *Homostachys* Baker was employed to designate those (non-Malayan) species having dimorphous leaves and sporophylls, where the larger sporophylls are found on the lower plane. The second main group is characterised by bilateral strobili and was referred to as Section *Heterostachyeae* by Ridley (1919), equivalent to an earlier designation as subgenus *Heterostachys* Baker (which contained species with dimorphous leaves and sporophylls, and larger sporophylls on the upper plane).

Within the group with tetragonous strobili, smaller groups of related species may be discerned:

(i) *S. wallichii* (Hk. & Gr.) Spring and *S. stipulata* (Bl.) Spring, set off from all other species by their very distinct manner of branching;

(ii) a group with consistently entire leaves in which *S. padangensis* Hieron., *S. delicatula* (Desv.) Alston, *S. mayeri* Hieron. and *S. cuprea* Ridl. have exauriculate leaves, while *S. willdenowii* (Desv.) Baker and *S. plana* (Desv.) Hieron. have auriculate axillary leaves;

(iii) *S. caulescens* (Wall.) Spring, *S. frondosa* Warb. and *S. argentea* (Wall.) Spring with remarkably similar erect habit and appressed leaves at the stem base, the latter feature not seen in other species with non-entire leaves;

(iv) *S. strigosa* Bedd., *S. ridleyi* Baker, *S. rivalis* Ridl. and *S. longiaristata* Hieron., all with a creeping habit and ciliolate to ciliate leaves;

(v) *S. griffithii* Spring, *S. selangorensis* Bedd. ex Ridl., *S. repanda* (Desv.) Spring, *S. roxburghii* (Hk. & Gr.) Spring and *S. intermedia* (B1.) Spring — suberect species with spreading lateral leaves at the stem base.

In the group with bilateral strobili, two smaller groups are easily distinguished:

(i) with creeping habit, in the lowlands mostly — in this group are *S. alutacia* Spring and *S. ciliaris* (Retz.) Spring (ciliate leaf margins) and *S. minutifolia* Spring, *S. curtisii* Ridl. and *S. scabrida* Ridl. (dentate leaf margins);

(ii) with suberect habit, at higher altitudes — in this group are *S. morgani* Zeiller, *S. ornata* (Hk. & Gr.) Spring and *S. polita* Ridl.

Nine species appear to be endemic to the Malay Peninsula: *S. cuprea, S. curtisii, S. morgani, S. polita, S. ridleyi, S. rivalis, S. scabrida, S. selangorensis* and *S. strigosa.*

The present account is based on sporophyte material. Finer structure, such as the surface ornamentation of leaves and spores as revealed by scanning electron microscopy, although not investigated here, is likely to provide supportive evidences towards understanding the relationships and differences between species. This avenue might also be explored in future investigations into variation within currently accepted species such as *S. alutacia* and *S. intermedia.*

An endeavour was made to keep features of the strobilus from dominating throughout the key, for frequent as strobili are in the field they may still be absent from specimens; this has likewise been the case for features of basal stem leaves, except where unavoidable. A combination of characters is employed where formerly a single character may be difficult to trace, such as the presence of a stoloniferous stem if only the aerial parts have been collected. Salient features of each species follow, together with a list of specimens examined. Thereunder, 'laterals', 'medians' and 'axillaries' refer to the corresponding leaves; branch-systems are abbreviated BS with reference to Fig. 1 The various herbaria mentioned are abbreviated thus: Forest Research Institute at Kepong (KLP), University of Malaya (KLU), Singapore (SING), Universiti Kebangsaan Malaysia (UKM) and Universiti Pertanian Malaysia (UPM).

Key to 28 Species of Peninsular Malaysian *Selaginella* (including 3 varieties)

1. Branch-systems exclusively pseudopinnate, the smaller axes very close together in distichous-type array, and not or slightly forking at the tips, the whole of each branch-system appearing lanceolate in outline,

 2. Axillary leaves similar in size to lateral leaves, not overlapping onto branchlets; each branchlet of the distichous array rarely forking, and bearing a single strobilus .... *S. wallichii*
 2. Axillary leaves larger than lateral leaves, overlapping onto branchlets; each branchlet of the distichous array often forking 1-2 times bearing 2-3 strobili at the tips .... *S. stipulata*

1. Branch-systems flabellate, if pseudopinnate then with much-branched smaller axes or else with branchlets well-spaced in between,

 3. Habit prostrate, rooting at intervals,

  4. Lateral leaves entire; axillary leaves along the main stem suborbicular .... *S. mayeri*
  4. Lateral leaves denticulate to ciliate; axillary leaves along the main stem ovate to elliptic,

   5. Lateral leaves denticulate,

    6. Stems glabrous; median leaves acuminate to shortly aristate,

     7. Strobilus with upper-plane sporophylls held steeply at less than 45° from the axis ...... *S. curtisii*
     7. Strobilus with upper-plane sporophylls held less steeply, at 45°-80° from the axis *S. minutifolia*

    6. Stems hairy; median leaves distinctly aristate .... *S. scabrida*

   5. Lateral leaves ciliolate to ciliate,

    8. Lateral leaves hairy to varying extents on upper side,

     9. Strobili tetragonous; lateral leaves hairy on upper side to both sides .... *S. strigosa*
     9. Strobili bilateral; lateral leaves hairy on upper side only .... *S. alutacia (p.p.)*

    8. Lateral leaves glabrous,

     10. Median leaves with arista exceeding lamina in length .... *S. longiaristata*
     10. Median leaves acuminate or with arista shorter than lamina,

      11. Median leaves entire to denticulate; strobili bilateral .... *S. ciliaris*

11. Median leaves ciliolate or ciliate; strobili either tetragonous or bilateral,

12. Lateral leaves elliptic; median leaves strongly ciliate .... *S. ridleyi*
12. Lateral leaves ovate; median leaves ciliolate,

13. Strobili tetragonous .... *S. rivalis*
13. Strobili bilateral .... *S. alutacia (p.p.)*

3. Habit suberect to stiffly erect, rooting in the lower half,

14. Lateral leaves entire or subentire to denticulate,

15. All leaves entire,

16. Axillary leaves auriculate,

17. Plants when fully developed scrambling with stems reaching a meter long or more; lateral leaves with an auriculate fold at the basal part of the upper margin; colour often bluish-green .... *S. willdenowii*

17. Plants not long scrambling; lateral leaves with an auricle at the basal part of the upper margin overlapping onto the branch; colour green .... *S. plana*

16. Axillary leaves exauriculate,

18. Colour coppery; median leaves aristate; lateral leaves elliptic-falcate to oblong-falcate .... *S. cuprea*
18. Colour green; median leaves acuminate to apiculate; lateral leaves oblong-falcate,

19. Plants reaching 60-80 cm tall; lateral leaves of main stem often more than 3 mm long; axillary leaves along main stem conspicuously large and orbicular, 3-4 mm across ...... *S. padangensis*
19. Plants smaller, to 40 cm tall; lateral leaves of main stem less than 3 mm long; axillary leaves along main stem obovate to suborbicular, to about 2 mm across .... *S. delicatula*

15. Median leaves denticulate; lateral leaves subentire to denticulate,

20. Branches fine, often less than 1 mm across; plants with fine stoloniferous connections and below 25 cm tall; lateral leaves grey-green below,

21. Lateral leaves ovate to lanceolate .... *S. selangorensis (p.p.)*
21. Lateral leaves oblong-falcate .... *S. griffithii (p.p.)*

20. Branches stout, at least 1 mm across; plants without stoloniferous connections and mostly to over 25 cm tall; lateral leaves dark green below, at times coppery .... *S. intermedia (p.p.)*

14. Lateral leaves dentate to ciliate,

22. Leaves at stem base erect-appressed, similar in size and distantly placed,

23. Lateral leaves of branch-system with a subspinose-ciliate projection at the basal part of the lower margin; leaves of stem base with one side of the base prolonged into a ciliate auricle and often subpeltate .... *S. caulescens*
23. Lateral leaves of branch-system without any subspinose-ciliate projection at the base; leaves of stem base cordate to auriculate,

24. All leaves with a distinct pale margin; upper margin of lateral leaves exauriculate; axillary leaves of main branch axes cordate to subauriculate .... *S. argentea*
24. Leaves without a distinct pale margin; upper margin of older lateral leaves auriculate; axillary leaves of main branch axes auriculate .... *S. frondosa*

22. Lateral leaves at stem base spreading and close together, distinctly larger than the median leaves,

25. Lateral leaves ciliolate to ciliate at base,

26. Median leaves acuminate .... *S. repanda*
26. Median leaves aristate,

27. Lateral leaves dentate to ciliolate .... *S. intermedia* var. *dolichocentrus (p.p.)*
27. Lateral leaves basally ciliate,

28. Plants often about 12 cm tall or more, without stoloniferous connections; main stems at least 1 mm across,

29. Lateral leaves glabrous .... *S. roxburghii*
29. Lateral leaves with upper surface short-hairy .... *S. roxburghii* var. *strigosa*

28. Plants often less than 12 cm tall, with fine stoloniferous connections; main stems fine, less than 1 mm across .... *S. selangorensis var. ciliata*

25. Lateral leaves denticulate to dentate,

30. Lateral leaves ovate to lanceolate,

31. Strobili bilateral; median leaves acuminate to shortly aristate (arista less than ⅕ lamina length),

32. Plants often in closely clumped turfs; lateral leaves ovate-triangular, 1-2 mm long .... *S. morgani*

32. Plants growing in well-spaced patches; lateral leaves ovate-lanceolate, often 3 mm long .... *S. polita*

31. Strobili tetragonous; median leaves distinctly aristate (arista ¼ to over ½ the lamina length) .... *S. selangorensis (p.p.)*

30. Lateral leaves oblong-falcate,

33. Strobili bilateral .... *S. ornata*
33. Strobili tetragonous,

34. Median leaves with arista distinctly exceeding lamina in length .... *S. intermedia* var. *dolichocentrus (p.p.)*
34. Median leaves with arista not exceeding lamina in length,

35. Branches fine, not more than 1 mm across; plants with fine stoloniferous connections and often below 25 cm tall; lateral leaves grey-green below .... *S. griffithii (p.p.)*
35. Branches stouter, at least 1 mm across; plants without stoloniferous connections and mostly to over 25 cm tall; lateral leaves dark green below, at times coppery .... *S. intermedia (p.p.)*

1. S. alutacia Spring, Bull. Ac. Brux. 10 (1843) 233, no. 154.
S. oligostachya Baker, Ann. Bot. 8 (1894) 132, no. 272.
S. montana Ridley, J.R. As. Soc. Str. Br. 80 (1919) 159, no. 33.

Creeping; BS 1,5, short; stem laterals close together, spreading; BS laterals ovate-triangular, ciliate with basally distended upper margin, exauriculate, glabrous to variously hairy on upper side; axillaries ovate, exauriculate, overlapping branches slightly; medians ciliate with arista often ½ to ⅔ lamina length; strobilus bilateral.

Specimens examined:

Johore: Gunong Pulai, *Ridley 12137* (SING); Gunong Panti, 1600 ft. alt., *Holttum SFN 18076* (SING).

Negri Sembilan: Gunong Angsi, *Ridley 11873* (SING), 2500 ft. alt., *Nur SFN 11562* (SING).

Malacca: Mt. Ophir, *Ridley 9889* (SING); *Ridley 3347* (SING, ISOTYPE of *S. oligostachya* Baker).

Selangor: Templer Park, *Shimizu et al M13766* (SING); Bt. Kanching For. Res., *Nur* s.n. 2.11.1937 (SING); Ulu Langat, *D. W. Lee Ul-4* (KLU); Semenyih, *Hume 7906* (SING); Bt. Enggang For. Res., Kajang, *Symington FMS 24113* (KEP); Gua Batu, *Ridley 8150* (SING); Ulu Sg. Gombak, *Shimizu et al M14003* (SING); Gombak, 20th mile, *K.M. Salleh KMS 245* (UKM); Bt. Kutu, *Ridley 7824* (SING), 3000 ft. alt., *Ridley 7829* (SING); Genting Simpah, *Hume 8497*

(SING), *9743* (SING), c. 1500 ft. alt., *Hume 8834* (SING), *9014* (SING), *9380* (SING), *9531* (SING).

Pahang: Way from K. Lumpur to Gunong Ulu Kali, c. 1200 m alt., *Shimizu et al M14065* (SING); Gunong Tahan, *Ridley 15959* (SING), Wray's Camp, *Ridley 16200* (SING, isotype of *S. montana* Ridley); P. Tioman, summit of Gunong Kajang, 3200-3400 ft. alt., *D.W. Lee KLU 19797* (KLU), below summit of Gunong Kajang, 3000 ft. alt., *D.W. Lee KLU 19730* (KLU).

Perak: Temango, *Ridley 14464* (SING), *14471* (SING), *14473* (SING); Gunong Kledang, *Ridley 9576* SING), *9577* (SING); Kledang Saiong, *Symington FMS 25791* (KEP); Bujong Malacca, *Ridley 9578* (SING), *Curtis 3308* (SING); Lumut, *Ridley 10349)* (SING), Dindings, *Curtis* s.n. Dec. 1902 (SING); Tapah, *Ridley 14024* (SING); Taiping Waterfall, *Ridley 14462* (SING); Taiping Hills, *Ridley 11425* (SING); Bt. Kepayong, Sg. Siput, *Ridley 11870* (SING).

Symington FMS 25791 from Perak has exceptionally hairy leaves. The varieties *S. alutacia* var. *curtisii* and *S. alutacia* var. *scabrida* of Alston (1934) are transferred back to their original specific identities (see text). For *S. alutacia* var. *pensile* (Ridl.) Alston, see end of listing.

Alston (1934) listed this species as possibly endemic but subsequently documented this for Java (Alston, 1934b) and Sumatra (Alston, 1937).

2. S. argentea (Wall.) Spring, Bull. Ac. Brux. 10 (1843) 137, no. 14.
Lycopodium argenteum Wall., Cat. (1829) no. 127; Hk. & Gr. in Hk. Bot. Misc. 2 (1831) 384. Plate 4

Stiffly erect; BS 3,4; stem base laterals distant from one another, appressed-erect, of similar size to medians, cordate-subauriculate with ciliate bases; BS laterals ovate-lanceolate to oblong-falcate, ciliolate to ciliate with basally distended upper margin, exauriculate; axillaries ovate, subcordate to subauriculate, overlapping branches slightly; medians dentate with arista often ⅓ to ½ lamina length; all leaves with distinct pale margin; strobilus tetragonous.

Specimens examined:

Pahang: Tanjong Antan, *Ridley 2166* (SING).

Kedah: Telaga Tujoh, *Ridley 15673* (SING).

Penang: Penang Hill, *Ridley 7035* (SING), *7083* (SING); Government Hill, *Ridley 5173* (SING); Waterfall, *Curtis 3059* (SING); Waterfall Gardens, *Wong FRI 32384* (KEP).

Sine loc., *Cantley 129* (SING).

3. S. caulescens (Wall.) Spring, Bull. Ac. Brux. 10 (1843) 137, no. 12.
Lycopodium caulescens Wall., Cat. (1829), no. 137; Hk. & Gr. in Hk. Bot. Misc. 2 (1831) 382.
S. peltata Presl, Abh. Bohm. Ges Wiss., ser. 5, 3 (1844) 582; Alston, Bull. Jard. Bot. Buit., ser. 3, 13 (1934) 441.

Stiffly erect; BS 3,4; stem base laterals distant from one another, appressed-erect, of similar size to medians, with one side of the base prolonged into a ciliate auricle and often subpeltate; BS laterals ovate-lanceolate to oblong-falcate, ciliolate to ciliate with basally distended upper margin, with a subspinose ciliate projection at the basal part of the lower margin, otherwise exauriculate; axillaries ovate, subcordate, overlapping branches slightly; medians acuminate to shortly aristate, denticulate, with a ciliate outer auricle, often subpeltate; strobilus tetragonous.

Specimens examined:

Perak: Jor, *Haniff SFN 14214* (SING), 1800 ft. alt., *Henderson FMS 10825* (SING).

Penang: Botanic Gardens, cultivated, *Curtis* s.n. (SING).

4. **S. ciliaris** (Retz.) Spring, Bull. Ac. Brux. 10 (1843) 231, no. 136.
Lycopodium ciliare Retz., Obs. 5 (1789) 32, no. 92.

Creeping; BS 1,5, short; stem laterals close together, spreading; BS laterals ovate-lanceolate to oblong-falcate, ciliate with basally distended upper margin, exauriculate; axillaries ovate, slightly cordate, overlapping branches; medians denticulate-subentire, acuminate; strobilus bilateral.

There are no Peninsula specimens available locally but the identity is clear from both Alston's key (1934) and non-Peninsula specimens at SING:

Borneo — stream below Dallas, *Holttum SFN 25370* (SING).

Papua — Kanosia, *Carr 11754* (SING).

This is certainly close to *S. alutacia* from which it differs by the nature of the medians.

5. **S. cuprea** Ridley, J. R. As. Soc. Str. Br. 80 (1919) 152, no. 14, excl. var. *major.*

Suberect; BS 4,6; stem base laterals close together, ascending to spreading, larger than medians; BS laterals elliptic-falcate to ovate-lanceolate, coppery in colour, entire, upper margin not or only slightly basally distended, exauriculate; axillaries ovate, overlapping branches slightly; medians entire with arista often ⅔ as long as lamina; strobilus tetragonous.

Specimens examined:

Selangor: Ulu Langat, near Dusun Tua, *D.W. Lee UL-55* (KLU); Sg. Batu, *Poore 220* (KLU).

Pahang: Sg. Tahan, *Md. Shah MS 1412* (KEP); Tahan, Wray's Camp, *Ridley 16198* (SING, syntype).

Perak: Bujong Malacca, *Ridley 9574* (SING, syntype).

Trengganu: Kemaman, Sg. Sisir, *Corner SFN 32262* (SING).

Kelantan: K. Pertang, *Haniff & Nur SFN 10377* (SING).

This appears endemic to the Peninsula.

6. **S. curtisii** Ridley, J.R. As. Soc. Str. Br. 80 (1919) 148, no. 2.
S. alutacia var. *curtisii* (Ridl.) Alston, Gard. Bull. S.S. 8 (1934) 56, **syn. nov.**

Creeping; BS 1,5, short; stem laterals close together, spreading; BS laterals ovate-triangular, denticulate-dentate with basally distended upper margin, exauriculate, glabrous; axillaries ovate, exauriculate, overlapping branches slightly; medians denticulate-dentate, acuminate; strobilus bilateral with the upper-plane sporophylls held steeply towards the strobilus axis, all sporophylls tightly imbricate.

Specimen examined:

Perak: Bujong Malacca, *Curtis 3378* (SING, holotype).

This is evidently very rare; no other specimens of this were encountered and both Ridley (1919) and Alston (1934) also cite the above single specimen.

7. **S. delicatula** (Desv.) Alston, J. Bot. 70 (1932) 282.
Lycopodium delicatulum Desv. ex Poir., Encycl. Suppl. 3 (1814) 554, no. 99.

Suberect, to about 40 cm tall; BS 3,4; stem base laterals distant, ascending, of similar size to medians; BS laterals oblong-falcate, entire, exauriculate and often pale green; axillaries elliptic-obovate, often broadly ovate to suborbicular on main stem, to about 2 mm across, exauriculate, not overlapping branches; medians entire, pointed to apiculate; strobilus tetragonous.

Specimens examined:

Selangor: Batu Caves, *D.W. Lee KLU 20822* (KLU).

Pahang: Bt. Chintamani limestone between Bentong and Karak, *Chin 449* (KLU).

Kedah: Kg. Naka, *Holttum SFN 19834* (SING); Langkawi, Pasir Hitam, *Hamzah B99* (KLU), Gunong Raya, *Haniff & Nur SFN 7156* (SING), North base of Gunong Raya, on granite, *Stone 14305* (KLU), between Ayer Hangat and Tanjong Ru on limestone, *Chin 504* (KLU), Telok Panchor Air on limestone slope, *Chin & Chia 2127* (KLU), Selat Panchor, on limestone rocks, *Henderson SFN 29190* (SING); Bt. Wang, *Haniff SFN 1202* (SING).

Penang: Chitty Temple, stone quarry, Curtis 3380 (SING).

Perlis: near Kangar, *Ridley* s.n. March 1910 (SING); Mata Air For. Res., *Wong FRI 32121* (KEP).

8. **S. frondosa** Warb., Monsunia 1 (1900) 105.

Stiffly erect, with stout stoloniferous connections, to about 25 cm tall; BS 3,4; stem laterals distant, erect-appressed, of similar size to medians, with ciliate usually incurved auricles; BS laterals oblong-falcate, ciliolate, older ones with base of upper margin auriculate; axillaries ovate, auriculate, overlapping branches slightly; medians denticulate, acuminate to shortly aristate; strobilus tetragonous.

Specimens examined:

Johore: Ulu Kahang c. 400 ft. alt., *Holttum SFN 10928* (SING).

Selangor: Ulu Langat, near Dusun Tua, *D.W. Lee UL-56* (KLU); Templer Park, *Wong FRI 32233* (KEP).

Pahang: Base of Kota Glanggi, *Henderson SFN 22496* (SING); West of Joara Bay, *Burkill SFN 1138* (SING); bank of Sg. Endau, *Betty & Latiff KLU 18557 (KLU); Taman Negara, Ugul KLU 21966* (KLU), K. Trenggan, *Stone & Wong KLU 13887* (KLU); Lesong For. Res., *Wong FRI 32389* (KEP); Krau Game Res. at Sg. Lompat, *Ruth Kiew RK 1046* (UPM).

Perak: Kamuning, *Curtis 3309* (SING); Tapah, *Wray 1761* (SING); Ulu Selama, *Wray 4156* (SING).

Kelantan: Gua Musang, Sg. Galas, *Henderson SFN 22602* (SING).

9. **S. griffithii** Spring, Bull, Ac. Brux. 10 (1843) 145, no. 80.

Suberect, with fine stoloniferous connections, often below 25 cm tall; BS 3,4 short; stem base laterals close together, spreading, larger than medians; BS laterals oblong-falcate, grey-green below, denticulate to subentire with slightly distended upper margin, exauriculate; axillaries ovate, exauriculate, overlapping branches slightly; medians denticulate with arista to more than half the lamina length; strobilus tetragonous.

Specimens examined:

Kedah: Langkawi, *Curtis* s.n. Sept. 1890 (SING), *Holttum SFN 17415* (SING), Gunong Raya, *Haniff & Nur SFN 7191* (SING).

Besides the different leaf shape, this is larger in stature than *S. selangorensis,* which in other aspects it resembles. This, however, has been collected in Malaya only from Langkawi, and also occurs in Thailand.

10. S. intermedia (Bl.) Spring, Bull. Ac. Brux. 10 (1843) 144, no. 66.
Lycopodium intermedium Bl., Enum. Pl. Jav. 2 (1830) 269, no. 20.
L. atro-viride Wall., Cat. (1829) no. 120; Hk. & Gr. in Hk. Bot. Misc. 2 (1831) 387.
S. atroviridis (Wall.) Spring, Flora 21 (1838) 183; Alston, Gard. Bull. S.S. 8 (1934) 53, excl. var. *ciliata.*
S. ascendens v.A.v.R., Bull. Jard. Bot. Buit., ser. 2, 11 (1913) 33; Alston, Gard. Bull. S.S. 8 (1934) 52, Bull. Jard. Bot. Buit., ser. 3, 14 (1937) 179.
S. cuprea var. *major* Ridl., J. R. As. Soc. Str. Br. 80 (1919) 152.
S. plumea Spring in Ridl., J. R. As. Soc. Str. Br. 80 (1919) 151. Plate 2

S. intermedia var. **intermedia**

Suberect, to 25-30 cm tall or more; BS 4,5,6; stem base laterals close together, spreading, larger than medians; BS laterals oblong-falcate, dentate to subentire (subdenticulate) often with basally distended upper margin, exauriculate, in nearly all cases glabrous; axillaries ovate, exauriculate, overlapping branches slightly; medians dentate, acuminate or (more often) with arista up to ¾ lamina length, sometimes hairy on upper side; strobilus tetragonous.

Specimens examined:

Johore: Gunong Pulai, summit, *Nur & Kiah SFN 7797* (SING), 300-650 m alt., *Iwatsuki, Fukuoka & Hutoh M 14172* (SING); Batu Pahat, *Ridley 11220* (SING); Kota Tinggi waterfall, *Md. Shah MS 445* (SING); Sg. Pelepah Kiri, *Corner SFN 33571* (SING), *33572* (SING).

Negri Sembilan: Gunong Angsi For. Res., *Osman FMS 23785* (KEP).

Selangor: Genting Simpah, *Hume 9603* (SING), *Nur SFN 34283* (SING); 15th mile Pahang Track, *Ridley 8770* (SING)*; Ulu Gombak, ridge top, *Strugnell FMS 27896* (KEP), For. Res. near Genting Simpah, 2500 ft. alt., *Wyatt-Smith KEP 79195* (KEP); Ulu Sg. Gombak, *Shimizu et al M 14006* (SING); Kajang, Sg. Lalang For. Res., *Symington FMS 22793* (KEP); Bt. Tunggul For. Res., *Jabil KEP 77661* (KEP); Ulu Langat, *D.W. Lee KLU 21965* (KLU), on summit ridge of Gunong Hitam near Kg. Ulu Lui, *D.W. Lee & Mahmud UL-29* (KLU); Gunong Nuang, false summit, 4800 ft. alt., *D.W. Lee UL-91* (KLU), summit ridge, *D.W. Lee* s.n. 15.8.1974 (KLU); University of Malaya campus, *Ugul KLU 21958* (KLU), Rimba Ilmu, *Low 79* (KLU); Bt. Lagong For. Res., 1500 ft. alt., *Abd. Samat b. Abdullah 145* (KLU).

Pahang: Jengka For. Res., *Evans 219* (KLU), half mile South of Sg. Kerut, *(Turnau 892* (KLU); P. Tioman, summit of Gunong Kajang, 3400 ft. alt., *D.W. Lee KLU 19732* (KLU); Gunong Tahan, 3300 ft. alt., *Wray & Robinson 5366* (SING), c. 5500 ft. alt., Seimund 194 (SING), Wray's Camp, *Ridley 16197* (SING); Sg. Tahan, *Kiah SFN 31723* (SING); Bt. Belar, Ulu Sg. Tembeling, *Md. Shah 1638* (KEP); Telom, *Ridley 13989* (SING); Fraser's Hill, *Kalong FMS*

22416 (SING), 4000-4370 ft. alt., *Burkill & Holttum 8453* (SING); Cameron Highlands, Robinson Falls, *Henderson SFN 11725* (SING); Southwest of Jerantut For. Res., *Wyatt-Smith KEP 93383* (KEP); Kota Glanggi, *Henderson SFN 22509* (KEP); Genting Highlands, 4000 ft. alt., *Noraini 32* (UKM).

Perak: Batu Salil, Gunong Korbu, *Strugnell & Tachun FMS 45857* (KEP); Dindings, Segari Melintang For. Res., *Strugnell FMS 16569* (KEP)*; Gunong Hijau, 4700 ft. alt., *Burkill SFN 12896* (SING); Gunong Kledang,, *Ridley 9571* (SING), Kledang Range, *Curtis 3310* (SING).

Kedah: Kedah Peak, *Ridley 5175* (SING), c. 3000 ft. alt., *Holttum SFN 15024* (SING), 3100 ft. alt., *Burkill 3315* (SING), 3400 ft. alt., *Lo & Mahmud 48* (KLU)*; P. Rumba, *Seimund* s.n. 12.3.1926 (SING); Langkawi, Gunong Raya, *Corner* s.n. 15.11.1941 (SING)*; Baling, *Md. Noor FMS 21627* (KEP).

Specimens marked with an asterisk conform to the features for *S. ascendens* (Alston, 1934), i.e., with 'lateral branches 1-2-forked.' However, many specimens have branching intermediate between this type and more extensively branched forms typical of *S. intermedia* and it is not uncommon to find both simpler and more complex branch-systems on one specimen.

Juvenile forms are obviously less branched and smaller, and root freely; I agree with Alston (1934) that the apparently creeping specimen, *Ridley 9990,* from Mt. Ophir (SING) is in a juvenile (also sterile) state.

Occasionally, the upper surfaces of medians are shortly hairy; very rarely the upper surfaces of both medians and laterals are hairy *(D.W. Lee* s.n. 15.8.1974 from Selangor, and *Noraini 32* from Pahang) — perhaps this may be a distinct variety.

There is also a smaller-leafed form of this species, with the lateral leaves less than 4 mm long, and coppery in colour. This has been called *S. cuprea* var. *major* by Ridley (1919) but is not admissible to that species because of dentate margins of the lateral leaves; it is appropriately noted by Alston (1934) as a small form of *S. atroviridis* (a synonym of *S. intermedia).* It is well to note that in *S. intermedia,* leaf size is a very variable character and colouration can vary from dark green to coppery or purplish hues. The following specimens conform to this smaller-leafed form:

Selangor: Genting Simpah, *Hume 8837* (SING); Bt. Hitam, *Ridley 7817* (SING).

Pahang: Gunong Tahan, Sg. Reriang, 3000-3500 ft. alt., *Holttum SFN 20597* (SING), Wray's Camp, *Ridley 16199* (SING); Bt. Chemaga, Chigar Perah, *Henderson SFN 19490A* (SING).

Perak: Taiping Waterfall, *Ridley 14460* (SING, SYNTYPE of *S. cuprea* var. *major* Ridl.); Temengoh, *Ridley 14468* (SING); Tapah, *Curtis 3112* (SING); Dindings, Lumut, *Curtis* s.n. Dec. 1902 (SING); Kledang Saiong, *Symington FMS 25870* (KEP); Gunong Bubu For. Res., *Hou 617* (KEP), 637 (KEP).

Kelantan: Ulu Mering, Sg. Brok, *Ng FRI 5467* (KEP).

S. intermedia var. **dolichocentrus** K.M. Wong, **var. nov.**

Plate 6

Caules suberectus in dimidio inferiore radicantes; foliis lateralibus falcato-oblonga margine dentatus vel ciliolatus; paginae infra plerumque griseo-viridis; foliis mediis aristis laminae longiores; sporophylla uniformes, strobili tetragoni.

Stems suberect, rooting in the lower half; lateral leaves oblong-falcate with dentate or ciliolate margin, surfaces below often grey-green; median leaves with arista exceeding lamina in length; sporophylls uniforms, strobili tetragonous.

TYPE: Ridley 13993 from Pahang, Telom (SING, **holotype**).

Specimens examined:

Johore: Mt. Ophir via Tangkak, 3000-4000 ft. alt., *Md. Shah & Samsuri MS 3598* (KEP, KLU).

Selangor: Semangkok Pass, *Ridley* s.n. 1904 (SING), *12038* (SING).

Pahang: Telom, *Ridley 13993* (SING); Gunong Berumbun, *Ridley 13992* (SING); Cameron Highlands, *Jaamat FMS 25180* (KEP), near Tanah Rata, *Henderson SFN 17721* (SING), *en route* from Tanah Rata to Habu area via Robinson falls, *Iwatsuki, Fukuoka & Hutoh M 13647* (SING); Bt. Fraser, 4000 ft. alt., *Smith 848* (SING), 3900 ft. alt., *Wong FRI 32033* (KEP).

Perak: Taiping, *Hervey 1667* (SING); Gunong Hijau, *Anderson 21* (SING); Gunong Bal, 4500 ft. alt., *Haniff SFN 14745* (SING); Maxwell's Hill, *Abd. Samat b. Abdullah 371* (KLU).

Penang: Government Hill, *Fox 10662* (SING).

This is the same as Alston's *S. atroviridis* var. (b), vide Alston (1934), which he subsequently suggested may be better placed under *S. roxburghii* (Alston, 1937). While this bears superficial resemblance to *S. roxburghii* in its grey-green colour on the lower side of the lateral leaves, as well as in the rather distended base of the upper margin of the lateral leaves, it is near to *S. intermedia* with its larger stature and ciliolate to dentate leaf margins. The occurrence of a markedly long median leaf arista can be accommodated within *S. intermedia* where the apex of the median leaf can vary from being acuminate to aristate. The grey-green colouration of the lower leaf surfaces and a distended base of the upper margin of lateral leaves occasionally occur in *S. intermedia* which, as Alston (1934) noted, is a very variable species.

The very long aristae of the median leaves (Plate 6) allow this variety to be easily distinguished from *S. intermedia* var. *intermedia*.

11. S. longiaristata Hieron., Hedwigia 50 (1910) 16.
S. atroviridis var. *ciliata* Spring in Alston, Gard. Bull. S.S. 8 (1934) 53; Bull. Jard. Bot. Buit., ser. 3, 14 (1937) 175.

Creeping; BS 3,4,5, short; stem laterals close together, spreading; BS laterals ovate, ciliolate, exauriculate; axillaries ovate, exauriculate, overlapping branches slightly; medians ciliolate with arista exceeding lamina in length; strobilus tetragonous.

There are no peninsular specimens available locally but the identity is clear from both Alston's key (1937) and a specimen from Sumbawa (*Colfs 13*, at SING) so determined by Alston in 1935. Alston (1934) cited only one specimen (from Malacca, collected by Griffith); this species would seem to be rather rare.

12. S. mayeri Hieron., Engl. & Prantl, Nat. Pfl. 1, 4 (1901) 700, no. 343.

Plate 1

Creeping; BS 1, 5, short; stem laterals close together, spreading; BS laterals oblong-falcate to slightly elliptic, entire or subentire with upper margin not or only slightly basally distended, exauriculate; axillaries obovate, orbicular on main stem, exauriculate, overlapping branches; medians entire, acuminate to apiculate; strobilus tetragonous.

Specimens examined:

Negri Sembilan: Jeram Toi, 250 m alt., *Amran AMF 6* (UKM), *Rashid NAR 3 (UKM).*

Selangor: Kepong, Abd. Samat b. Abdullah s.n. 18.11.1961 (KLU), Forest Research Institute grounds, *Wong FRI 32016* (KEP), path to Bt. Lagong, *Wong FRI 32019* (KEP).

Pahang: Taman Negara, *Ugul KLU 21961* (KLU), Sg. Teku, *Kiah* s.n. 23.7.1936 (SING), Tembeling, *Holttum SFN 24728* (SING), Gua Tipus, *Henderson SFN 22552* (SING), Gunong Senyum, *Henderson SFN 22230* (SING), *Henderson SFN 22322* (SING); Fraser's Hill, 1350 m alt., *K.M. Salleh KMS 250* (UKM).

Perak: Between 19th & 20th mile Tapah — Tanah Rata road, *Turnau 1139* (KLU); Tanjong Malim, *Ridley 11857* (SING).

Penang: Chitty Temple, stone quarry, *Curtis* s.n. Aug. 1896 (SING); waterfall, *Curtis 1734* (SING).

Kelantan: Gua Musang, *Boey 315* (KLU), limestone outcrop, *Chin 86* (KLU), *Chin 1419* (KLU); Gua Tapah limestone hill, *Chin 1608* (KLU); Sg. Keteh, Batu Papan, *Nur SFN 12081* (SING).

13. S. minutifolia Spring, Mem. Ac. Belg. 24 (1850) 239, no. 176.

Creeping; BS 1,4,5, short; stem laterals close together, spreading; BS laterals ovate to triangular, denticulate with basally distended upper margin, exauriculate; axillaries ovate, exauriculate, overlapping branches slightly; medians denticulate to ciliolate, acuminate to shortly aristate; strobilus bilateral.

Specimens examined:

Selangor: Bt. Kutu, anon., May 1891 (SING); Ulu Langat, Gunong Hitam, 3970 ft. alt., *D.W. Lee & Mahmud UL-34* (KLU); Templer Park, near base of Bt. Takun, *Abd. Samat. b. Abdullah 592* (KLU); Bt. Anak Takun, *Chin 15* (KLU).

Pahang: Fraser's Hill, 1350 m alt., *Md. Sarif MSAM 7* (UKM).

Kedah: anon., *SFN 37860* (SING); Langkawi, Telaga Tujoh, *Razali RJ 661* (UKM).

14. S. morgani Zeiller, Bull. Soc. Bot. Fr. 32 (1885) 78.

Suberect; BS 1,5, short; stem base laterals close together, spreading, larger than medians; BS laterals ovate with blunt apex, dentate with upper margin slightly to well distended basally, exauriculate; axillaries ovate, exauriculate, overlapping branches; medians dentate, acuminate; strobilus bilateral.

Specimens examined:

Pahang: Cameron Highlands, below forest station, *Poore 160* (KLU), *Turnau 943* (KLU), ridge, 6000 ft. alt., *Wyatt-Smith* s.n. (KEP), Break Pressure Tank Hill, *Burkill 842* (SING), Brinchang Village, *Poore 98* (KLU), Gunong Brinchang, 6600 ft. alt., *University of Malaya 8061* (KLU), near Tanah Rata, *Turnau 1266* (KLU); Gunong Siku, *Jaamat FMS 27658* (KEP); Gunong Berumbun, upper part, *Poore 580* (KLU).

Perak: Gunong Raya, 5700 ft. alt., *Strugnell & Tachun FMS 45875* (KEP).

15. S. ornata (Hk. & Gr.) Spring, Bull. Ac. Brux. 10 (1843) 232, no. 145.
Lycopodium ornatum Hk. & Gr. in Hk. Bot. Misc. 3 (1833) 108.
S. ornata sensu Alston, *p.p.*, Gard. Bull. S.S. 8 (1934) 57-58. Plate 7

Suberect; BS 4,5,6, stem base laterals close together, spreading, larger than medians; BS laterals oblong-falcate, denticulate to dentate with basally distended upper margin, exauriculate; axillaries ovate-subcordate, exauriculate, overlapping branches; medians denticulate to dentate, with arista often more than half the lamina length; strobilus bilateral.

Specimens examined:

Negri Sembilan: Jeram Toi, 250 m alt., *Rashid NAR 4* (UKM).

Selangor: Semangkok Pass, *Ridley 12039* (SING); Gunong Nuang, summit, *D.W. Lee* s.n. 15.8.1974 (KLU).

Pahang: Fraser's Hill, *Nur SFN 11020* (SING), *Corner* s.n. 13.8.1937 (SING), on trail to Pine Tree Hill, *Burkill 2339* (SING), 4400 ft. alt., *D.W. Lee KLU 19735* (KLU), 1350 m alt., *K.M. Salleh KMS 274* (UKM), *Rashid NAR 10* (UKM); Cameron Highlands, near forest station, *Poore 157* (KLU); Gunong Tahan, *Haniff & Nur SFN 7974* (SING); Gunong Bunga Buah, 3600 ft. alt., *Zaleha Yunos UKM 2092* (UKM).

Perak: Birch's Hill, *Wray* s.n. (SING); Maxwell's Hill, *Ridley 5181* (SING); Gunong Hijau, *Sinclair & Kiah SFN 38676* (SING).

Penang: Penang Hill, 2000 ft. alt., *Holttum SFN 31198* (SING).

It appears that Alston's concept of *S. ornata* (Alston, 1934) contained two distinct groups (see text) of which one is maintained as *S. ornata* here while the other has been determined as *S. polita* Ridley.

16. S. padangensis Hieron., Hedwigia 50 (1910) 34.

Suberect, with a broad spread, reaching 60-80 cm tall; BS 3,4; stem base laterals distant, ascending to spreading, of similar size to medians; BS laterals oblong-falcate, entire, slightly to (often) not auriculate; axillaries along main stem conspicuously large and orbicular, 3-4 mm across, exauriculate, not overlapping branches; medians entire, acuminate to apiculate; strobilus tetragonous.

Specimens examined:

Selangor: Genting Simpah, *Hume 9386* (SING); Bt. Takun, base, *Wong FRI 32049* (KEP, KLU); Batu Caves, inside dark cave, *Ugul & Bala KLU 21964* (KLU); Kepong, Forest Research Institute, path to waterfall, *Wong FRI 32012* (KEP, KLU); Gombak, University of Malaya Field Studies Centre, *Willis* s.n. 1.4.1974 (UKM).

Pahang: Tembeling, *Holttum SFN 24696* (SING); 6 miles north of Bentong, *Burkill & Haniff SFN 16537* (SING).

Perak: Kg. Tera, Grik, *Ismail KEP 95034* (KEP).

17. S. plana (Desv.) Hieron., Engl. & Prantl, Nat. Pfl. 1, 4 (1901) 703, no. 363.

Lycopodium planum Desv. ex Poir., Encycl. Suppl. 3 (1814) 554, no. 98.

Suberect; BS 3,4,6; stem base laterals distant, ascending to erect, of similar size to medians; BS laterals oblong-falcate, entire to subentire, with an auricle at the basal part of the upper margin; axillaries obovate to orbicular, strongly auriculate; medians entire, apiculate to shortly aristate; strobilus tetragonous.

Specimens examined:

Pahang: Fraser's Hill, by path to Phenological Plot, 3900 ft. alt., *Wong FRI 32046* (KEP).

Penang: Waterfall Gardens, *Nur SFN 5330* (SING).

Alston (1934) listed only one specimen, from Johore (Henderson SFN 18365).

18. S. polita Ridley, J. F. M. S. Mus. 6 (1911) 202.
S. ornata sensu Alston *p.p.* Gard. Bull. S.S. 8 (1934) 57-58. Plate 8

Suberect; BS 1,4,5, short; stem base laterals close together, spreading, larger than medians; BS laterals ovate-lanceolate, dentate with upper margin slightly to well distended basally, exauriculate; axillaries ovate, exauriculate, overlapping branches; medians dentate, acuminate to shortly aristate; strobilus bilateral but the upper-plane sporophylls only slightly longer than those of the lower plane.

The stature of the plant is smaller than that of *S. ornata.*

Specimens examined:

Pahang: Cameron Highlands, near forest station, *Poore 159* (KLU), Break Pressure Tank Hill, 4900 ft. alt., *Burkill 841* (SING), Gunong Brinchang, *Littke WL 350* (UKM), Blue Valley, *Kasim & Zai UKM 1417* (UKM); Cameron Highlands road, *Abd. Samat. b. Abdullah 331* (KLU); Fraser's Hill, 1350 m alt., *K.M. Salleh KMS 253* (UKM).

PERAK: Gunong Hijau, *Fox* s.n. Oct. 1899 (SING), 4500 ft. alt., *Haniff & Nur SFN 2459* (SING), 4750 ft. alt., *Burkill SFN 12885* (SING).

This species was previously (Alston, 1934) included under *S. ornata,* from which it is distinct (see there).

19. S. repanda (Desv.) Spring, Gaudich., Voy. Bonite Bot. 1 (1844-46) 329.
Lycopodium repandum Desv. ex Poir, Encycl. Suppl. 3 (1814) 558.

Suberect; BS 1,5, short; stem base laterals close together, spreading, larger than medians; BS laterals ovate-lanceolate, dentate and basally ciliate with basally distended upper margin, exauriculate; axillaries ovate, exauriculate, overlapping branches slightly; medians dentate with ciliate base, acuminate; strobilus tetragonous.

Specimen examined:

Perlis: *Ridley 14770* (SING).

This is one of three specimens cited by Alston (1934).

20. S. ridleyi Baker, Ann. Bot. 8 (1894) 131, no. 58.

Creeping, very little branched; BS 1; BS laterals elliptic, densely ciliate, glabrous; axillaries elliptic, densely ciliate, exauriculate, overlapping branches slightly; medians ovate, acuminate, strongly ciliate; strobilus tetragonous.

Specimen examined:

Malacca: Gunong Mering, Mt. Ophir, rocks in stream, *Ridley 3346* (SING, isotype).

Both Ridley (1919) and Alston (1934) cited only the type specimen. Ridley commented that this grew on submersed or usually wetter rocks in streams.

Recent collection at Mt. Ophir yielded only *S. alutacia* in such habitats. *S. ridleyi* would seem to be extremely rare.

21. S. rivalis Ridley, Kew Bull. (1924) 266.

Creeping; BS 1,5, short; stem laterals close together, spreading; BS laterals ovate, with blunt apex, finely ciliate, exauriculate; axillaries ovate, exauriculate, overlapping branches slightly; medians ciliolate to finely ciliate, acuminate; strobilus tetragonous.

Specimens examined:

Selangor: Logging track, 1000 ft. alt., *Evans 239* (KLU); 17th mile track, Bentong road, *Evans* s.n. 1.7.1965 (KLU).

Alston (1934) listed only three specimens and this species being endemic.

22. S. roxburghii (Hk. & Gr.) Spring, Bull. Ac. Brux. 10 (1843) 228, no. 115. *Lycopodium roxburghii* Hk. & Gr. in Hk. Bot. Misc. 2 (1831) 390, no. 135.

S. roxburghii var. **roxburghii**

Suberect; BS 3,4,5; stem base laterals close together, spreading, larger than medians; BS laterals oblong-falcate to (occasionally) ovate-lanceolate, grey-green below, ciliate at the base, with basally distended upper margin, exauriculate, glabrous; axillaries ovate, subcordate, exauriculate, overlapping branches; medians ciliolate to ciliate with arista ⅔ of to nearly the same length as lamina and sometimes longer; strobilus tetragonous.

Specimens examined:

Johore: Castlewood, *Ridley 9192* (SING); Patani, Batu Pahat, *Ridley 10984* (SING); Gunong Pulai, *Ridley 12134* (SING), *Iwatsuki, Fukuoka & Hutoh M 14168* (SING); Mt. Austin, *Ridley 12570* (SING); Kota Tinggi, *Ridley 15451* (SING); Kluang, *Holttum SFN 9238* (SING); Gunong Blumut, *Holttum SFN 10674* (SING).

Negri Sembilan: Gunong Angsi, *Ridley 11866* (SING), *Nur SFN 11502* (SING), *Holttum SFN 9930* (SING); Gunong Tampin, *Holttum SFN 9610* (SING); Senaling Inas For. Res., *Holttum SFN 9794* (SING).

Malacca: Ayer Panas, *Ridley 1616* (SING); lower part of Mt. Ophir, *Ridley* s.n. 1892 (SING).

Selangor: Ampang, lower reservoir, *Strugnell FMS 13977* (KEP); Kajang, Sg. Lalang For. Res., *Symington FMS 22792* (KEP); Ulu Langat, above Kg. Sg. Serai, *D.W. Lee UL-7* (KLU), ridge above Sg. Tekali, *D.W. Lee UL-50* (KLU), Ugul KLU 21957 (KLU).

Pahang: Gunong Raja, *Best SFN 13856* (SING).

Perak: Taiping Waterfall, *Curtis* s.n. Oct. 1895 (SING); Kledang Saiong, *Symington FMS 25800* (KEP).

Penang: Penang Hill, *Ridley 9227* (SING), *14159* (SING); Government Hill, *Curtis 3054* (SING), *3056* (SING); Penara Bukit, *Curtis* s.n. June 1895 (SING); Tiger Hill, *Sinclair SFN 39111* (SING); near Waterfall, *Ridley* s.n. Dec. 1895 (SING).

Kedah: Kuala Muda, Bt. Perah, *Shamsuddin FMS 35107* (KEP).

Trengganu: Kemaman, Bt. Kajang, *Corner SFN 32260* (SING), Sg. Jerumgaja, *Corner SFN 32261* (SING), Sg. Nipah, *Corner SFN 32268* (SING); Bundi, *Rostado SFN 11977* (SING), s.n. Feb. 1904 (SING).

Singapore: Bt. Timah, *Ridley* s.n. 28.7.1900 (SING), Nature Res., *Fukuoka S 14342* (SING).

Gard. Bull. Sing. 35(2) (1982)

Corrigendum

Replace 1st line on page 131 by:
S. **roxburghii** var. **strigosa** (Ridley) K.M. Wong, **comb. nov.**
S. *trichobasis* var. *strigosa* Ridley, J. R. As. Soc. Str. Br. 80 (1919) 153, **syn. nov.**

S. roxburghii var. **strigosa** Ridley, J. R. As. Soc. Str. Br. 80 (1919) 153.

With the upper surface of lateral leaves short hairy, especially on the basiscopic half (i.e., nearer the lower margin).

Specimens examined:

Johore: Sg. Pelepah Kiri, *Corner SFN 33570* (SING).

Kedah: Koh Moi For. Res. *Kiah SFN 35123* (SING).

Penang: Penang Hill, *Ridley 7133* (SING), *en route* from Penang Hill to Tiger Hill, *Shimizu et al M 13139* (SING), *M 13149* (SING).

This variety was recognized by Ridley (1919) but Alston (1934) reduced it, as well as *S. trichobasis* Baker, to *S. roxburghii.*

23. S. scabrida Ridley, J. R. As. Soc. Str. Br. 80 (1919) 159.
S. alutacia var. *scabrida* (Ridley) Alston, Gard. Bull. S.S. 8 (1934) 56, **syn. nov.**

Creeping; BS 1,5, short; stems hairy; stem laterals close together, spreading; BS laterals ovate-triangular, denticulate to dentate with basally distended upper margin, exauriculate, hairy on both surfaces; axillaries ovate, exauriculate, overlapping branches slightly; medians denticulate to dentate with arista half to three-quarters the lamina length; strobilus bilateral with sporophylls shortly ciliolate and hairy.

Specimens examined:

Pahang: Gunong Tahan, *Ridley 15960* (SING, isotype), *15954* (SING), Sg. Reriang, *Holttum SFN 20574* (SING).

Alston (1934) cited *Ridley 15954* to connect *S. alutacia* var. *pensile* (Ridley) Alston (see end of listing) with the ordinary form of *S. alutacia;* however, this specimen is *S. scabrida* Ridley, having the characteristics above.

24. S. selangorensis Beddome ex Ridley, J. R. As. Soc. Str. Br. 80 (1919) 148.
S. microdendron Ridley, loc. cit. 150.

Suberect, hardly 10 cm tall, with fine stoloniferous connections; BS 1,5, short; stem base laterals close together, spreading; BS laterals ovate to lanceolate, pale green below, denticulate with basally distended upper margin, exauriculate; axillaries ovate, exauriculate, overlapping branches slightly; medians denticulate, acuminate to aristate with arista half to three-quarters the lamina length; strobilus tetragonous.

Specimens examined:

Selangor: Semangkok Pass, *Ridley 12040* (SING, isotype).

Pahang: Sg. Tahan near K. Teku, *Holttum SFN 20800* (SING).

Penang: Penang Hill, *Ridley 7085* (SING, isotype of *S. microdendron* Ridl.); near Western Hill, *Holttum SFN 19312* (SING).

Apart from the smaller stature and ovate-lanceolate leaves, this may be mistaken for *S. griffithii* which has been collected in the Malay Peninsula only from Langkawi in the North-west. I could not locate the three specimens of *S.*

selangorensis var. *ciliata* Alston at Singapore, but its stoloniferous habit with basally ciliate lateral leaves (Alston, 1934) should make it distinctive.

25. S. stipulata (Bl.) Spring, Bull. Ac. Brux. 10 (1843) 145, no. 70.
Lycopodium stipulatum Bl., Enum. Pl. Jav. 2 (1830) 268, no. 18.
S. polystachya sensu Alston, Gard. Bull. S.S. 8 (1934) 46, non (Warb.) Hieron. in Engl. & Prantl, Nat. Pfl. 1, 4 (1901) 702.
S. permutata sensu Alston, Bull. Jard. Bot, Buit., ser. 3, 14 (1937) 175.

Suberect; BS consistently 2; leaves of main stem similar in size to, or slightly larger than those of BS, spreading to ascending; BS laterals oblong-falcate, entire, not auriculate; axillaries along the main stem conspicuously larger than laterals, ovate to suborbicular, exauriculate, overlapping branches; medians entire, acuminate to apiculate to shortly aristate; strobilus tetragonous.

Specimens examined:

Johore: Sg. Pelepah Kiri, *Corner 33567* (SING); Lombong Waterfall, North of Kota Tinggi, *Abd. Samat b. Abdullah 539* (KLU).

Negri Sembilan: Gunong Angsi, *Wong FRI 32056* (KEP); Jeram Toi, *Ramli RY 7* (UKM); Ulu Kelewang, *D.W. Lee* s.n. (KLU).

Selangor: Batu Perdinding, *Nur* s.n. 2.11.1937 (SING); Sg. Lalang For. Res., *Symington FMS 22794* (KEP); Ulu Langat, *D.W. Lee & Ugul KLU 21962* (KLU), JKA catchment area above Kg. Sg. Serai, *D.W. Lee UL-2* (KLU), *UL-3* (KLU); Ampang, lower reservoir, *Strugnell FMS 13976* (KEP), Intake catchment reserve, *Wong FRI 32224* (KEP); Gombak, 1200 m alt., *Ramli RY 8* (UKM), Ulu Gombak, 22nd mile, *Stone 5733* (KLU), roadside, *Wyatt-Smith KEP 55802* (KEP); University of Malaya campus, Rimba Ilmu, *Low 90* (KLU).

Pahang: Genting Simpah, *Stone 7431* (KLU), *Nur SFN 34282* (SING), *Poore 241* (KLU), *Poore 263* (KLU); Sg. Cheka, *Holttum SFN 24770* (SING); Fraser's Hill, *Poore 41* (KLU), *Shimizu et al M 13844* (SING), 1350 m alt., *Md. Sarif* s.n. 17.12.1981 (UKM); Cameron Highlands, top of Gunong Brinchang, *Stone 5583-A* (KLU); Sg. Teku, *Kiah SFN 31708* (SING).

Perak: Path to Gunong Bujong Melaka, *Md. Shah & A. Shukor MS 3380* (KEP, SING); Kledang Saiong, *Symington KEP 25699* (KEP), *Sow FMS 33665* (KEP); Gunong Bubu For. Res., *Hou 639* (KEP).

Trengganu: Kemaman, Bt. Kajang, *Corner SFN 30387* (SING), Sg. Nipah, *Corner SFN 32266* (SING); Ulu Brang, *Kiah SFN 33813* (SING); Gunong Padang, *Kiah SFN 33946* (SING).

Kelantan: Bt. Chemaya, *Henderson SFN 19479* (SING); Pasir Depok, *Haniff & Nur SFN 10212* (SING); K. Mering, Sg. Brok, *Ng FRI 5471* (KEP).

While enumerating species in the Malay Peninsula, Alston (1934) listed *S. polystachya* as being present, and under this he noted a possible variety which is 'more slender' with 'stem leaves smaller, often spreading' and 'spikes usually solitary.' Later, he considered that the Malayan species in question had been wrongly referred to *S. polystachya* and was in fact identical to *S. permutata* (Alston, 1937). He also noted that *S. stipulata* was the correct identity of the variety he had earlier (Alston, 1934) placed under *S. polystachya*. These two taxa recognized by Alston (1934; 1937) are in fact conspecific, the size of leaves being variable, and the shape of the axillary leaf varying from ovate to suborbicular. The earliest name *S. stipulata* is adopted for this single species.

26. S. strigosa Beddome, Kew Bull. (1911) 192, no. 600.

Creeping; BS 1,2,5, short; stem laterals close together, spreading; BS laterals ovate, ciliate with basally distended upper margin, exauriculate, hairy on upper surface to both surfaces; axillaries ovate to elliptic, exauriculate, not or slightly overlapping branches; medians ciliate with arista nearly as long as lamina; strobilus tetragonous.

Specimens examined:

Johore: Kluang, Gunong Blumut, *Ng KEP 98051* (KEP).

Negri Sembilan: Gunong Angsi, Ulu Pedas, *Nur SFN 11721* (SING).

Selangor: Genting Bidai, *Ridley 7815* (SING), *7825* (SING); Klang Gates, *Ridley 13442* (SING), *Sinclair SFN 40140* (KEP).

27. S. wallichii (Hk. & Gr.) Spring, Mart. Fl. Bras. 1, 2 (1840) 124.
Lycopodium wallichii Hk. & Gr. in Hk. Bot. Misc. 2 (1831) 384, no. 106.
Plate 5

Stiffly erect; BS consistently 1; stem base laterals distant, ascending, of similar size to medians; BS laterals oblong-falcate, entire, not or (rarely) slightly auriculate at base of upper margin; axillaries ovate to elliptic, exauriculate, not overlapping branches; medians entire, acuminate to apiculate; strobilus tetragonous.

Specimens examined:

Johore: near Gunong Panti, *Audas* s.n. 31.8.1941 (SING).

Negri Sembilan: Pasoh For. Res., *Evans 222* (KLU).

Selangor: Semenyih, *Hume 7819* (SING); Kajang, Sg. Lalang For. Res., *Symington FMS 24071* (KEP); Bt. Cheraka For. Res., *Jabil KEP 77654* (KEP); Sg. Buloh, *Burkill SFN 11870* (SING) Klang Gates, *Hume 7235* (SING); Genting Simpah, *Turnau 778* (KLU), 12th mile, *Strugnell FMS 13083* (KEP), 21½ mile, *Sinclair 9835* (SING); Gunong Bunga Buah, Seraya-rich ridge, 2700 ft. alt., *Wong FRI 32226* (KEP); Gombak, University of Malaya Field Centre, *Jayamohan s.n. 8.8.1974 (KLU) off 19th mile, Wong FRI 32071* (KEP); Ulu Langat, *Ugul KLU 21960* (KLU), at head of Sg. Langat drainage, *D.W. Lee UL-51* (KLU).

Pahang: Kota Glanggi, *Henderson SFN 22495* (SING); Jengka For. Res., *Poore 1416* (KLU); near Sg. Endau, *Betty & Latiff KLU 18597* (KLU); Fraser's Hill, *Burkill 2067* (SING); Sg. Handerik, Ulu Serau, *Osman FMS 28320* (KEP); K. Trenggan, *Stone & Wong KLU 13886* (KLU).

Perak: Maxwell's Hill, *Wray Jr. 23* (SING); Gunong Bujang, *Evans 25* (KLU).

Kedah: K. Muda, Bt. Perak, *Samsuddin FMS 33142* (KEP).

Trengganu: Kemaman, Sg. Nipah, *Corner SFN 32269* (SING).

28. S. willdenowii (Desv.) Baker, Gard. Chron. (1867) 783.
Lycopodium willdenowii Desv. ex Poir., Encycl. Suppl. 3 (1814) 540, no. 87.
Plate 3

Suberect, often scrambling over other vegetation; BS 3,4; stem base laterals distant, ascending, of similar size to medians; BS laterals oblong-falcate, often bluish above, entire, with an auriculate fold at the basal part of the upper margin; axillaries ovate to elliptic, strongly auriculate; medians entire, acuminate; strobilus tetragonous.